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This Standard establishes and defines the human factors engineering requirements for the definition, design, development, test and evaluation of Intercontinental Ballistic Missiles (ICBM) Systems including AVE, OSE, MSE and facilities. It implements the provisions of AFR 800-15, Human Factors Engineering and Management, with AFSC Supplement 1 thereto, and AFR 80-14, Test and Evaluation, and AFSC Supplement 1 thereto. The standard identifies the responsibilities for the development and implementation of a human factors engineering program, defines the detailed requirements for developing a Human Factors Development Plan (HFDP), and for contractor performance in accordance with the plan.

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SAMSO STANDARD

HUMAN FACTORS ENGINEERING

FOR

INTERCONTINENTAL BALLISTIC MISSILE SYSTEMS

" Interim use of this
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DEPARTMENT OF THE AIR FORCE
Space and Missile Systems Organization
Air Force Systems Command

Human Factors Engineering for Intercontinental Ballistic Missile Systems

SAMSO-STD-77-1

1. This SAMSO Standard is approved for use by Space and Missile Systems Organization (AFSC).

2. Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: SAMSO/MNTP, Norton AFB, CA, 92409.

FOREWORD

This SAMSO Standard describes the human factors engineering requirements for an intercontinental ballistic missile system, including related equipment. Applicable provisions of AFR 800-15, Human Factors Engineering and Management, and AFR 80-14, Test and Evaluation, and the AFSC supplements to those regulations are incorporated herein. All ICBM Contractors will be required to conduct a Human Factors Engineering Program in accordance with this standard. Recognizing there will be differences in the various portions of the program and the work to be performed by each contractor, this standard may be appropriately tailored in each contract statement of work.

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1. SCOPE

1.1 Purpose. This Standard establishes and defines the human factors engineering requirements for the definition, design, development, test and evaluation of Intercontinental Ballistic Missiles (ICBM) Systems including AVE, OSE, MSE and facilities. It implements the provisions of AFR 800-15, Human Factors Engineering and Mangement, with AFSC Supplement 1 thereto, and AFR 80-14, Test and Evaluation, and AFSC Supplement 1 thereto. The standard identifies the responsibilities for the development and implementation of a human factors engineering program, defines the detailed requirements for developing a Human Factors Development Plan (HFDP), and for contractor performance in accordance with that plan.

1.2 Application. This standard is applicable to all ICBM weapon systems development and to all personnel assigned to and in support of ICBM weapon systems programs.

1.3 Objectives of the human factors engineering program. The objectives of the human factors engineering program are to ensure that:

a. The human role in the system is defined in order to optimize performance in relation to that specific system, including operations and organizational, intermediate and depot level maintenance functions.

b. Adequate man-machine analyses and trade studies are accomplished, beginning with the conceptual phase and, as appropriate, continuing throughout the system life cycle. These studies must consider life cycle costs, system performance requirements, system complexity, and the capability of available personnel to perform the intended function.

c. Human Factors Engineering specialists assist in defining and designing all equipment where human performance will be required.

d. Workplace and workplace environment is optimally designed to support human performance.

e. Biomedical analysis and design support activities include the environmental protection necessary to promote human health and safety and enhance human performance capability.

f. Air Force personnel will have the training necessary to conduct the system test and evaluation program activities.

2. REFERENCED DOCUMENTS

2.1 Issues of documents. The following documents of the issue in effect on date of invitation for bids or requests for proposals form a part of this Standard to the extent specified herein.

2.1.1 Specifications

MIL-D-26239	Data, Qualitative and Quantitative Personnel Requirements Information (QQPRI)

2.1.2 Standards

MIL-STD-1472	Human Engineering Design Criteria for Military Systems, Equipment and Facilities
MIL-STD-1521	Technical Reviews and Audits for Systems, Equipment and Computer Programs
SAMSO-STD-77-6	System Requirements Analysis Programs for the MX Weapon System

2.1.3 Other Publications

ED 77-3	Integrated Test Plan for MX Weapon System
DH 1-3	Human Factors Engineering, AFSC Design Handbook

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions shall be obtained from the procuring activity or as directed by the Contracting Officer.)

3. DEFINITIONS

3.1 Confirm. A qualitative test that requires comparison of test results to an applicable requirement.

3.2 Critical task criteria. Critical tasks are those that require human performance which, if not accomplished in accordance with system requirements, will most likely have adverse effects on cost, system reliability, nuclear hardness and survivability, efficiency, health or safety. Human performance shall also be considered critical whenever equipment design characteristics demand performance which approaches the limits of human capabilities and thereby significantly contributes to the occurrence of one or more of the following conditions, but not necessarily limited thereto:

a. Jeopardized performance of an authorized mission.

b. Degradation of the circular error probability to an unacceptable level.

c. Delay of a mission beyond acceptable time limits: e.g., human time to react will not meet required systems reaction time.

d. Improper operation resulting in a system "no-go," inadvertent weapon firing, or failure to achieve operational readiness status.

e. The exceeding of predicted times for maintenance personnel and Maintenance Support Equipment (MSE) to complete maintenance tasks. Performance times will be considered critical if the total maintenance response time significantly exceeds maintenance analysis estimates, or affects MSE quantitative requirements.

f. A significant degradation of launch of flight reliability.

g. The damaging of system equipment, resulting either in a return to a maintenance facility for major repair, or an unacceptable cost, spare requirements, or system down time.

h. A serious compromise of weapon system security.

i. Injury to personnel.

j. Any unacceptable degradation of system nuclear hardness and survivability.

3.3 Demonstrate. A qualitative test that does not require comparison of test results to an applicable requirement.

3.4 Determine. A quantitative test that does not require comparison of test results to an applicable requirement.

3.5 Evaluate. A quantitative test that requires comparison of test results to an applicable requirement.

3.6 Gross analysis of tasks. A gross analysis of tasks is a time-oriented description of the human-equipment interactions by an operator in accomplishing a unit of work with an item of equipment. It shows the sequential and simultaneous manual and intellectual activities of the person operating, maintaining or controlling equipment, rather than a sequential operation of the equipment.

3.7 Human factors engineering (HFE). Human factors engineering is that functional part of systems engineering which defines the human performance necessary to operate, maintain, support and control a system in its intended operational environment. The terms "human factors" and "personnel subsystems" are sometimes used as synonyms for human factors engineering. The following are elements of human factors engineering:

3.7.1 Human engineering. Human engineering is the application of knowledge about human capabilities and their limitations to the system or equipment design, to achieve desired system performance requirements through the most effective use of human performance capabilities.

3.7.2 Biomedical. The biomedical element provides for the promotion of health and safety and for the protection, sustenance, escape, survival, and recovery of personnel employed within the total system environment. This support will be provided for operations, maintenance and support personnel under

both normal and emergency conditions. It will also include health protection from conditions resulting from system functions for any personnel who are not included in the total system complex, but who will be affected by the system.

3.7.3 Manpower and personnel requirements. This element includes the development of manpower and personnel requirements to ensure that the appropriate number of trained personnel are available to operate, maintain, control, and support the system or equipment. Data developed in managing this element serve as the basis for manpower and personnel planning and programming decisions. All human factors engineering requirements must be considered early enough in the acquisition life cycle to permit the training and assignment of trained personnel at the initial operational date of each system.

3.7.4 Training. This human factors engineering element includes all training provided, conducted, or managed by the using command, ATC, or the contractor. It incorporates, as a minimum, the trained personnel requirements, training plan, training equipment development, training support data and training facilities. All components of this element will be defined, designed, procured, and conducted based on a task analysis of system requirements.

3.7.5 Human factors test and evaluation (HFTE). Human factors test and evaluation includes all testing directed toward validation and evaluation of human factors engineering analyses, studies, criteria, decisions and design characteristics and features. These include engineering design tests, model tests, mock-up evaluations, demonstrations, subsystem and system Development Test and Evaluation (DT&E), and Operational Test and Evaluation (OT&E). The OT&E is comprised of Initial Operational Test and Evaluation (IOT&E) and Follow-on Test and Evaluation (FOT&E).

3.8 HFTE Observer/Evaluator. A qualified human factors engineer assigned by the contractor to observe and evaluate tests of equipment/material which may have some impact on human factors elements.

3.9 Unique acronyms. The following unique acronyms are used in this SAMSO Standard:

AFS	Air Force Specialty
AFSC	Air Force Specialty Code
AFSC	Air Force Systems Command
AFTEC	Air Force Test and Evaluation Center
CFE	Contractor Furnished Equipment
CI	Configuration Item
DT&E	Development Test and Evaluation
FOT&E	Follow-On Test and Evaluation
HFDP	Human Factors Development Plan
HFE	Human Factors Engineering

HFTE	Human Factors Test and Evaluation
IOT&E	Initial Operational Test and Evaluation
ITP	Integrated Test Plan
MSE	Maintenance Support Equipment
OSE	Operational Support Equipment
OT&E	Operational Test and Evaluation
QQPRI	Quantitative and Qualitative Personnel Requirements Information
SRA	System Requirements Analysis
TPA	Test Planning Analysis
UER	Unscheduled Event Record

4. GENERAL REQUIREMENTS

4.1 General. Contractor shall implement a human factors engineering program in accordance with this Standard as tailored in the SOW. Where the requirements of this standard conflict with other referenced or applicable documents, the requirements of this standard shall apply.

4.2 Contractors. Contractors shall:

a. Establish and maintain a human factors engineering program.

b. Present unresolved intercontractor problems to SAMSO for resolution.

c. Participate in human factors engineering meetings convened by SAMSO, or other associate contractors with SAMSO approval.

d. Maintain close liaison with other contractors and SAMSO.

e. Establish a single point of contact for the conduct of the human factors engineering program.

f. Include the applicable portions of this standard in subcontracts and purchase orders.

g. Assign an HFTE Observer/Evaluator(s), as defined in 3.8, to observe/evaluate designated tests and prepare documentation pertaining thereto as described in Appendix C and assign a qualified human factors engineer to support the HFTE working groups.

4.3 Nonduplication. The efforts performed to fulfill the human factors engineering requirements specified herein shall be coordinated with, and shall not duplicate, efforts performed in accordance with other contractual requirements. Necessary extensions or transformations of the results of other efforts for use in

the human factors engineering program and duplication of tests to satisfy HFTE objectives will not be considered duplication. Instances of potential duplication or conflict shall be brought to the attention of the Contracting Officer.

5. DETAILED REQUIREMENTS

5.1 Human Factors Development Plan (HFDP). The HFDP shall be prepared in accordance with Appendix A.

5.2 Human engineering and biomedical. The human engineering and biomedical program shall include active participation in the system engineering analyses, and in the design and development of hardware and software end items and facilities. The requirements of MIL-STD-1472 and the applicable specifications shall be satisfied and the information contained in DH 1-3 shall be used as a guide.

5.2.1 Human factors engineering analyses in support of systems engineering. The contractor's human factors engineering personnel shall participate in the development of the System Requirements Analysis (SRA) program required by SAMSO-STD-77-6 to define the human interface requirements, and shall conduct the following analyses.

5.2.1.1 Function flow analysis. The human factors engineering personnel shall participate in analyses to develop functional flow diagrams required by SAMSO-STD-77-6 for all CFE to assure that human performance criteria, constraints and requirements are properly identified.

5.2.1.2 Gross analysis of tasks. Gross analysis of tasks shall be conducted and shall be documented in the functional requirements, task analysis and personnel requirements sections of the analyses defined in SAMSO-STD-77-6. Those gross tasks which are related to configuration items of equipment to be operated or maintained by personnel at the organizational, intermediate and depot levels, and which require critical human performance, reflect possible unsafe practices, or are subject to promising improvements in operating efficiency, shall be so identified in the HFDP, Appendix A, or in subsequent progress reports, Appendix D. Upon approval by the procuring activity, these tasks shall be further analyzed as critical tasks.

5.2.1.3 Critical task analysis. The contractor shall perform critical task analyses, and shall record the results thereof in accordance with Appendix B.

5.2.1.4 Timeline analyses. Support the development of timeline analyses required by SAMSO-STD-77-6, using the task data from the System Requirements Analysis (SRA) and the Critical Task Analyses.

5.2.2 Human engineering and biomedical requirements in equipment and facility design. Assure that the results of human engineering analyses and biomedical criteria are applied, along with other design requirements, to the design and development testing of equipment intended to be operated, controlled or maintained by Air Force personnel.

5.2.2.1 Preliminary subsystem and equipment design. Human engineering criteria shall be applied to subsystem and equipment designs. The approval of the following documents by the contractor shall signify that the subsystem and equipment configuration and arrangement satisfy human performance requirements and comply with applicable criteria specified in MIL-STD-1472 and other human factors engineering criteria specified by the contract:

a. Design criteria documents.

b. Trade studies reports.

c. Specifications.

d. Drawings and data such as subsystem and equipment schematic diagrams.

e. Interface control drawings.

f. Overall layout drawings and related applicable drawings provided in compliance with contract data requirements.

5.2.2.2 Studies, experiments and engineering development and laboratory tests. The contractor shall conduct studies, experiments and laboratory tests as approved in the HFDP, as amended, to resolve human engineering and biomedical problems associated with specific contractor furnished equipment. The results of these studies, laboratory tests and experiments shall be incorporated into equipment design and shall be reported in progress reports required by Appendix D. Requirements for special studies, experiments and laboratory tests on other than contractor furnished equipment shall be recommended in progress reports required by Appendix D.

5.2.2.3 Mockups and models. The contractor shall consider the use of full-scale three-dimensional mockups of equipment involving critical human performance. All mockups shall be available for inspection by SAMSO during normal working hours.

5.2.2.3.1 Development engineering mockups and models. The contractor shall consider use of full-scale three-dimensional mockups of equipment involving critical human performance, and shall include human engineering requirements when developing such mockups and models. Make maximum use of these mockups and models during human factors engineering studies.

5.2.2.3.2 Major human factors engineering mockups and models. If the engineering mockups do not satisfy human factors engineering requirements, special mockups may be proposed by the contractor in progress reports in accordance with Appendix D. Human factors engineering mockups and models shall reflect current design progress and changes. The workmanship shall be no more elaborate than is essential to determine the adequacy of size, shape, arrangement, and panel content of equipment used by personnel. The most

inexpensive materials practical shall be used for fabrication. These mockups and models shall provide a basis for resolving access, workspace and related human engineering and biomedical problems, and incorporating these solutions into design.

5.2.2.4 Dynamic simulation. Dynamic simulation techniques shall be utilized as a human factors engineering design tool when necessary for the detail design of equipment requiring critical human performance. Simulation development shall be proposed in progress reports required by Appendix D. While the simulation equipment is intended primarily for use as a design tool, its potential relationship to, or use as, training equipment shall be considered in any plan for dynamic simulation.

5.2.3 Human engineering and biomedical requirements in equipment and facility detail design. The human engineering and biomedical analyses required by this standard, and other appropriate human factors engineering data, shall be used in detail equipment and facility design.

5.2.3.1 Equipment and facility detail design drawings. The release of contractor approved equipment and facility drawings by the contractor shall verify that human factors engineering and biomedical requirements are incorporated thereon.

5.2.3.2 Equipment and facility design. Equipment and facility designs which affect human performance under both normal and emergency conditions, shall include consideration of the following:

a. Atmospheric conditions (including composition, volume, pressure, temperature, humidity, and air flow).

b. Weather and climate aspects (rain, hail, snow, dust, mud, arctic, mountain, desert, wind conditions, etc.).

c. Range of accelerative forces, positive and negative (including linear, angular, and radial).

d. Acoustical noise (steady state and impulse), vibration, and impact forces.

e. Adequate space for personnel, their movement, and their equipment.

f. Adequate physical, visual, and auditory links between personnel, and between personnel and their equipment (including eye position in relation to display surfaces, control, and external visual areas).

g. Walkways, stairways, platforms and inclines that are safe under both normal and unusual conditions.

h. Provisions to minimize physical or emotional fatigue, or fatigue due to work-rest cycles.

i. Provisions to minimize psycho-physiological stresses.

j. Effects of clothing and personal equipment including arctic clothing.

k. Equipment handling provisions (including tools and provisions for remote handling, when material and environment require them).

l. Protection from chemical, biological, toxicological, radiological, and electromagnetic hazards.

m. Illumination commensurate with anticipated visual tasks.

n. Sustenance storage requirements (i.e., oxygen, water, and food), and provisions for housekeeping and refuse management.

o. Crew safety protective constraints (shoulder, lap, and leg restraint systems) in relation to mission phase and control and display utilization.

5.2.3.3 Equipment procedures development. Tasks and procedures developed through the human factors engineering analyses required by SAMSO-STD-77-6 and 5.2.1.3 of this standard shall be incorporated into the training media and technical publications.

5.2.3.4 Human engineering and biomedical criteria compliance reviews. The contractor shall conduct detailed reviews of each item of the contractor-furnished equipment to ensure compliance with the requirements of MIL-STD-1472 and other human factors engineering criteria specified by the contract. At appropriate times during system development, including design reviews conducted in accordance with MIL-STD-1521, the SAMSO Human Factors Division (MNTP) shall conduct formal or informal reviews of selected contractor-furnished equipment.

5.2.3.5 Human engineering and biomedical deficiencies. Design deficiencies which adversely affect human engineering or biomedical factors of the equipment shall be reported in accordance with Appendix D.

5.3 Manpower and personnel requirements. The contractor shall conduct manpower and personnel studies and analyses based on the weapon system SRA data, specifications, drawings and other engineering data, and shall report the results in accordance with Appendix E. These studies and analyses should support the requirements of 3.2.1a and 3.2.1b of MIL-D-26239A (USAF).

5.4 Human factors test and evaluation.

5.4.1 Objectives. The contractor shall conduct the HFTE in accordance with approved test plans and analysis (Integrated Test Plan, Test Planning Analysis, other test plans, etc.), and assure the following objectives are satisfied:

a. Evaluate/confirm that human engineering, biomedical and maintainability design requirements have been met and that facilities and equipment design

properly support personnel performance in achieving the system operability, maintainability, nuclear hardness maintainability, safety, and reliability objectives.

b. Evaluate/confirm that the work environment provides conditions for safe, healthful, effective and reliable personnel performance.

c. Confirm that procedures provide complete and understandable instructions for:

1) Maintaining a normal mode of operations.

2) Maintenance.

3) Backout.

4) Abort.

5) Emergency recovery.

d. Evaluate/confirm that the proper number of personnel are identified and trained for operations and maintenance.

e. Confirm that the available tools, test equipment, personnel equipment, job aids, and spares support personnel performance.

f. Confirm that fault isolation to the lowest line replaceable unit at the organizational level of maintenance, and to the replaceable component (card, etc.) at the intermediate level of maintenance can be accomplished by specified personnel using operationally configured MSE and procedures.

g. Confirm that training provided to selected Air Force personnel enables them to properly operate, maintain, control, and support the system.

h. Evaluate/confirm the ability of trained selected Air Force personnel, using verified Technical Orders, to perform system operations and maintenance.

5.4.2 Human factors test and evaluation factors. The contractor shall evaluate the following HFTE factors during the test program. Results of the evaluation shall be recorded in accordance with Appendix C.

5.4.2.1 Maintenance/logistics.

5.4.2.1.1 Objectives.

a. Confirm that specified maintenance support equipment supports personnel performance.

b. Confirm that the available provisioned spares, when installed in accordance with the technical data, clear the malfunction.

5.4.2.1.2 Criteria.

a. Specified maintenance support equipment for the system shall effectively support the requirements of operations and of the organizational and intermediate maintenance functions.

b. Recommended spares shall permit the specified response to malfunctions, and if provisioned and installed in accordance with technical data, the spares shall clear the malfunction and return the equipment to an operable condition.

5.4.2.2 Biomedical support.

5.4.2.2.1 Objectives. Confirm that biomedical provisions support safe, healthful, effective and reliable human performance during operations and maintenance tasks.

5.4.2.2.2 Criteria.

a. Perceived illumination levels shall support required personnel functions during operation on normal, survival and emergency power.

b. Perceived acoustical levels present within all occupied areas shall not preclude normal communications between personnel or interfere with the intended use of the area.

c. Other biomedical provisions, within applicable criteria limits, shall contribute to the achievement of effective system operations and maintenance functions.

5.4.2.3 Workspace layout.

5.4.2.3.1 Objectives. Confirm that workspace layout, including communications provisions, supports operations and maintenance tasks.

5.4.2.3.2 Criteria. Workspace accommodations and access to equipment, including communications provisions, shall effectively permit operations and maintenance tasks by personnel with body dimensions the same as the 5th percentile woman and the 95th percentile aviator, as defined in MIL-STD-1472.

5.4.2.4 Equipment design/maintainability.

5.4.2.4.1 Objectives. Confirm that equipment design supports personnel performance during operations and maintenance tasks.

5.4.2.4.2 Criteria. Equipment design shall facilitate accomplishment of operations, periodic inspection, efficient fault detection, isolation and repair with a minimum of time and effort.

5.4.2.5 Technical data.

5.4.2.5.1 Objectives. Confirm that technical data supports human performance.

5.4.2.5.2 Criteria.

a. Verified operations and maintenance technical data, when used by trained personnel, shall effectively support weapon system readiness and operations requirements.

b. Corrective maintenance tasks, performed in accordance with verified technical data, shall effectively restore the weapon system to an operable condition.

5.4.2.5.3 Test constraints. During operational or simulated operational tests involving late prototype or operationally configured hardware, software, and Air Force personnel, only verified technical orders shall be used to satisfy HFTE objectives, specified in 5.4.1g. and h. However, if in order to expedite testing, HFTE observations are conducted during technical order verification and changes are made to the technical orders during the verification activity, the HFTE data shall be invalid unless a SAMSO test representative, an HFTE working group representative, or, in their absence, the HFTE observer/evaluator shall certify that the technical order changes, induced interruptions or other anomalies had no impact on the validity of the HFTE data.

5.4.2.6 Timeline validation.

5.4.2.6.1 Objectives. Evaluate the accuracy of operational and maintenance times established in the SRA or CI specifications and determine the performance time for tasks that do not have times so established.

5.4.2.6.2 Criteria. The actual performance time shall not exceed the established performance time.

5.4.2.7 Training.

5.4.2.7.1 Objectives.

a. Confirm that contractor personnel are trained.

b. Confirm that special system training provided to selected Air Force personnel enables them to perform the tasks to meet the objectives of paragraphs 5.4.1g. and h.

5.4.2.7.2 Criteria.

a. Contractor personnel are capable of performing system operations and maintenance tasks.

b. Air Force personnel, trained in their respective specialty classifications, are capable of operating and maintaining the system.

5.4.2.8 Personnel requirements.

5.4.2.8.1 Objectives.

a. Confirm that the number of contractor personnel, as specified in the SRA are sufficient to perform operations and maintenance tasks.

b. Confirm that the numbers and types of Air Force personnel specified in the SRA or QQPRI can accomplish operations and maintenance tasks.

5.4.2.8.2 Criteria.

a. The predicted number of personnel are effective in achieving operations and maintenance tasks.

b. The Air Force Specialty Code and the number of Air Force personnel prescribed in the SRA data or the QQPRI are effective in achieving operations and maintenance task performance.

5.4.2.9 Personnel safety.

5.4.2.9.1 Objectives.

a. Confirm that emergency procedures support human performance.

b. Confirm that notes, cautions and warnings are included in the technical data and, when necessary, information, warning and caution placards are prominently displayed on the equipment.

c. Confirm that procedures and equipment do not contribute to personnel injury or equipment damage.

5.4.2.9.2 Criteria.

a. All necessary caution, warning, and emergency procedures are identified in the technical data, and are followed without incident 100% of the time.

b. All necessary caution and warning placards are installed on equipment and followed without incident 100% of the time.

c. Facilities and equipment design does not contribute to personnel hazard.

5.4.2.10 Test anomalies. Test deficiencies which cannot be categorized as HFTE factors shall be classified as test anomalies. These anomalies shall include:

a. Administration

1) Ineffective job control practice in dispatch

2) Ineffective test conditions

b. Test planning/implementation

1) Commercial power failure

2) Equipment failure

3) Unexpected weather conditions, earthquakes, floods, etc.

c. Human error

1) Ineffective test subject due to fatigue, inattention, physiological impairment, etc.

5.4.3 HFTE test data analysis and reporting.

5.4.3.1 Test data analysis. Post-test analyses of all acquired test data shall be conducted by an HFTE Observer/Evaluator to determine the cause of deficiencies and propose corrective action. Data pertaining to the HFTE factors shall be analyzed against applicable system criteria. The impact a deficiency may have on HFTE factors shall be determined. These analyses shall include the following, as applicable:

a. An evaluation of the acquired data to establish spares effectiveness.

b. An evaluation of the acquired data to establish maintenance support equipment effectiveness.

c. A human engineering and biomedical support assessment to determine if environmental conditions are adequate for system operations and maintenance, and to determine potential performance degradation if such environmental conditions are not adequate.

d. An evaluation of performance errors or deficiencies during the tests to determine their relationship to environmental conditions.

e. Review of human engineering design criteria compliance records to determine that all changes to military standards have been identified.

f. An evaluation of performance errors or deficiencies during the tests to determine their relationship to identified human factors criteria changes.

g. An evaluation of performance errors or deficiencies to determine their relationship to equipment design criteria.

h. An evaluation of the specific recorded changes by correlating the specific deficiencies recorded by the observer with data obtained by post-test

interview. Test participant personnel data shall be reviewed to determine whether the deficiencies may be attributed to training, technical data, or other HFTE factors.

i. An evaluation of recorded technical data deficiencies and induced delays or other anomalies to determine the impact on the validity of the recorded test data with respect to each of the HFTE factors, including confirmation of the adequacy of the technical data.

j. Comparison of the observed operations and maintenance times with the times specified in the SRA or CI specification. Any deviations from the predicted operations or maintenance times shall be identified in test data analyses. An engineering assessment shall be made to determine the causes and impact on system functions of such time differences.

k. An evaluation of training deficiencies to determine whether they are detrimental to operations or maintenance task performance.

l. A post-test analysis to determine consistency among the AFSCs specified in the SRA or QQPRI, AFSCs specified in the technical data and the AFSCs actually used.

m. An evaluation of the test participant data to determine whether the participants met the qualification requirements of the AFSC.

n. An evaluation of each SRA or QQPRI deviation that caused a deficiency to determine whether the deviation contributed to performance deficiency, whether the SRA or QQPRI should be changed, and whether the deviation caused weapon system degradation.

o. An evaluation of safety-related deficiencies identified during the execution of tasks and of all personnel injury or equipment damage data to determine the cause of such safety problems or incidences.

p. An evaluation of test anomalies to determine their impact on the validity of test observations/results for each of the HFTE factors.

5.4.3.2 Test reporting. HFTE test results shall be summarized and reported by an HFTE Observer/Evaluator in accordance with Appendices C and D.

6. NOTES

6.1 Related documents. The following documents may be used to provide a better understanding of the requirements herein:

AFR 80-14	Test and Evaluation
AFSC Suppl 1 to AFR 80-14	Test and Evaluation

AFR 800-15	Human Factors Engineering and Management
AFSC Suppl 1 to AFR 800-15	Human Factors Engineering and Management
AFM 50-2	Instructional System Development
AFP 50-58	Handbook for Designers of Instructional Systems
MIL-STD-470	Maintainability Program Requirements (for Systems and Equipment)

6.2 Data Item Description (DID) references. Data requirements associated with this standard are not deliverable unless specified by the Contract Data Requirement List (CDRL). The data normally associated with this standard include the following:

Data Item Description	Title	Paragraph	Source Document
DI-H-3251	Personnel Subsystem/Human Factors Development Plan	5.1, 5.2.1.2, 5.2.2.2, 5.2.2.3.2, 5.2.2.4, 5.2.3.5, and 5.4.3.2	(ATCM 375-1)
DI-H-3261A	Human Engineering Design Approach Document	5.2.1.2, 5.2.1.3, & 5.2.1.4	(MIL-STD-1472B)
DI-H-3253	Qualitative and Quantitative Personnel Requirements Information (QQPRI), Part I: Field and Organizational Maintenance	5.3	(MIL-D-26239)
DI-H-3254	Qualitative and Quantitative Personnel Requirements Information (QQPRI), Part II: Depot Level Support	5.3	(MIL-D-26239)
DI-H-3272	Personnel Subsystem Test and Evaluation (PSTE) Plan	5.4.2 & 5.4.3.2	(MIL-STD-1472)

6.3 Meetings and reviews. Contractor human factors engineering personnel shall participate in TI/TD meetings, design review meetings, etc., to assist in assuring that requirements of MIL-STD-1472, MIL-STD-1521, and this standard, as these documents are modified by contract, are met.

6.4 Responsibilities. Responsibilities for the development and implementation of the human factors engineering program described herein are defined below.

6.4.1 SAMSO. The SAMSO ICBM Human Factors Division will:

a. Manage the overall human factors engineering program.

b. Establish the Human Factors Board. The Human Factors Board is chaired by the SAMSO ICBM Human Factors Division and is composed of members from AFSC, AFLC, ATC, SAC, AFTEC and other DOD agencies as may be designated. The Board has the responsibility for ensuring that:

(1) All human factors engineering objectives as defined in AFSC Supplement 1 to AFR 800-15 are accomplished.

(2) Full human factors engineering technical support is made available.

(3) All participating Air Force agencies are represented in human factors engineering decisions.

(4) Human factors engineering activities are coordinated with integrated logistics support, system engineering, system safety and other program activities.

c. Identify and resolve problems in conjunction with the human factors board.

d. Convene and chair meetings with contractors as required to provide proper program management.

e. Review, evaluate and approve the human factors engineering plans, effort and data to assure the timely achievement of human factors engineering goals.

f. Establish the Human Factors Test and Evaluation Working Groups (HFTE W/G) composed of representatives, as required, from AFSC, SAMSO, AFLC, SAC, SAC AFTEC, other DOD agencies, and contractors. The HFTE W/G is chaired by a SAMSO representative.

6.5 Manpower and personnel studies and analyses. The objective of these studies and analyses shall be to integrate all manpower and personnel requirements into an organizational structure to support manpower and personnel planning requirements of SAMSO, SAC, ATC, AFLC and other Air Force agencies.

APPENDIX A

HUMAN FACTORS DEVELOPMENT PLAN (HFDP)

10. SCOPE

10.1 Purpose. This appendix identifies and defines certain elements which the contractor is required to incorporate into his HFDP, and provides instructions for the preparation of that plan.

10.2 Application. This appendix is a mandatory requirement of this standard and is applicable to all ICBM Program associate contractors.

20. REFERENCED DOCUMENTS. (Not applicable.)

30. DEFINITIONS. (Not applicable.)

40. GENERAL REQUIREMENTS

40.1 Content. The HFDP shall contain a detailed description of how the processes and products of the human factors engineering effort will be developed and utilized in the context of the overall system activities. The contractor shall provide a discussion of the substantive topics in sufficient depth to assure that human factors engineering considerations, requirements and potential problems are clearly explained. Include all system operations and organizational, intermediate and depot levels of maintenance functions and interfaces for which the contractor is responsible.

50. DETAILED REQUIREMENTS

50.1 Plan outline. The plan shall be prepared in accordance with DI-H-3251, as may be modified, and shall include the following elements:

50.1.1 Title page.

50.1.2 Table of contents.

50.1.3 Scope.

50.1.4 Human factors engineering organization. The HFDP shall contain a description of:

a. The organization responsible for the development and implementation of the human factors engineering program.

b. Contractor's human factors engineering organization and human factors engineering management personnel.

c. Qualifications of personnel assigned to human factors engineering development tasks.

d. Level of effort proposed for human factors engineering development tasks by man-hours, percent of individual time, or other suitable method.

e. Human factors engineering organizational and functional relationship with other contractor units.

f. Procedures to be used in obtaining human factors engineering products from subcontractors.

50.1.5 Human engineering and biomedical. These elements shall be treated in the same section of the HFDP. The plan shall contain:

a. For each configuration item of Contractor Furnished Equipment (CFE), including facilities, estimates of the human factors engineering design considerations, and the HFE interface with other equipment end items and facilities by completing sections A and C (HFE Design and Test Considerations and Contractor Interface Resolution) of the HFE matrix shown in Figure 1. The Matrix shall be completed to the level of identified equipment or facilities, and the codes needed to complete the matrix shall be provided by the Contractor.

b. An estimate of the critical human engineering and biomedical problems by CFE number and the methods proposed for attaining recommended solutions.

c. A review by CFE item of the human engineering and biomedical studies which will be performed to support tradeoff studies, resolve problems, support analyses or contribute to the item design.

d. Recommendations for special human engineering and biomedical studies which might be out of scope of the current contract. Such studies might involve system level problems not specifically related to the CFEs or interfaces which are the prime responsibility of another contractor. Recommended studies of this kind will be implemented only by contract change.

e. An estimate of the utilization of laboratory facilities and CFE engineering mockups and simulators to study and resolve problems, and to verify design decisions and human tasks.

f. Recommendations for the development of special mockups or simulators required to support the development of CFE. The recommendations shall include, as a minimum, a description of the requirement, utilization, expected results, and the consequences of not providing mockups.

g. A listing of the critical tasks requiring a critical task anaiysis.

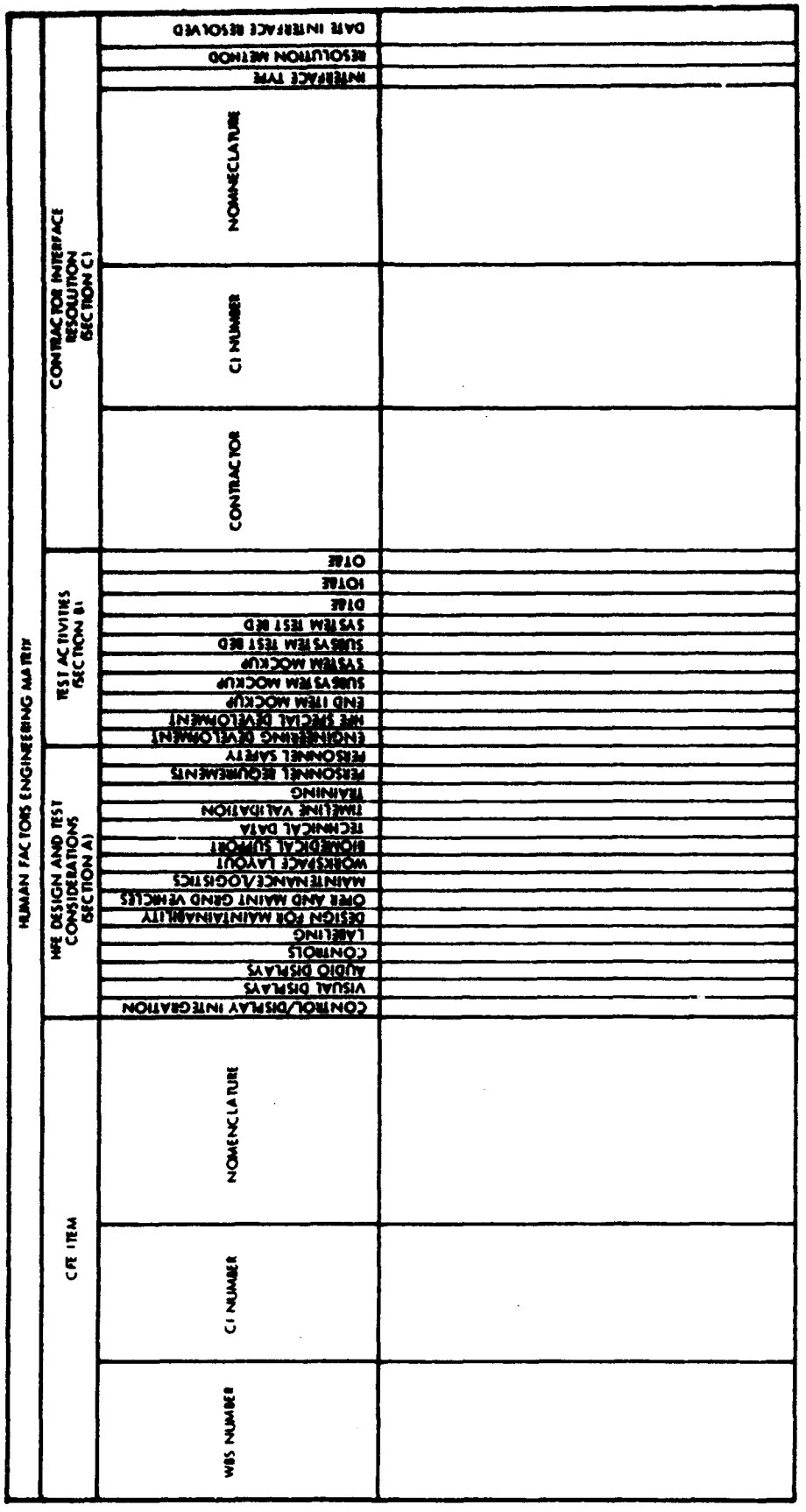

FIGURE 1. Human Factors Engineering Matrix.

50.1.6 Human factors test and evaluation. The plan shall include:

a. Test Schedules.

b. Completed section B (Test Activities) of the Human Factors Engineering Matrix, Figure 1.

c. HFTE test data recording, evaluation and reporting requirements specified in 10.2.b of DI-H-3272 accomplished in accordance with Appendix C.

50.1.7 Human Factors Master Milestone Schedule. The plan shall include a complete Human Factors Engineering Master Milestone Schedule, showing the time span of human factors engineering functions, significant human factors engineering outputs, and the interface of human engineering functions with major program milestones.

60. NOTES

60.1 Updates. Updates of the HFDP will be as required by the contractor's CDRL.

APPENDIX B

CRITICAL TASK ANALYSES

10. SCOPE

10.1 Purpose. This appendix specifies the format of and provides instructions for preparation and recording of critical task analyses.

10.2 Applicability. This appendix is a mandatory requirement of this standard and is applicable to all ICBM Program associate contractors.

20. REFERENCED DOCUMENTS. (Not applicable.)

30. DEFINITIONS. (Not applicable.)

40. GENERAL REQUIREMENTS

40.1 Layout drawing types. The critical task analyses shall be keyed to one or more work station layout drawing types (dimensioned plan view, 3-view, isometric). The drawings shall identify features such as consoles, panels, panel layout, illumination, personnel protective devices, emergency provisions, and other items pertinent to human performance.

40.2 Coding. Certain codes are provided in Figure 2 for use in preparing critical analysis documentation. Additional codes may be used subject to prior approval of the procuring agency.

50. DETAILED REQUIREMENTS

50.1 Preparation. Prepare in accordance with DI-H-3261A.

50.2 Layout drawings. Layout drawings used with the critical task analyses shall include:

a. The configuration and arrangement of major items of equipment for manned stations, such as weapon system operations or maintenance stations.

b. The configuration and arrangement of items of equipment, such as maintenance support equipment, which may not be part of a regularly manned station but which require equipment access for maintenance.

c. The arrangement of interior lighting for operating or maintaining the equipment.

d. The labels identifying general panel content (e.g., flight mission, security status, communications or malfunction status).

CRITICAL TASK ANALYSIS INSTRUCTIONS

COLUMN TITLE	CRITERIA FOR DATA ENTRY	EXPLANATION CODE
Information Required/ Available	Entries in this column shall be narrative in form. The narrative shall identify the information needed to perform the task. All instances of information required but not available shall be flagged and an entry placed in the remarks column which will clearly identify the impact on task performance.	N/A
Evaluation/Decision	Column entries shall be in narrative form. The analysis shall identify what if any evaluation or decision components are included in the task. Where evaluation/ decision sequences are identified, the analysis shall call out the sequence the operator will have to go through in order to use the information.	N/A
Task	Column entries shall be in narrative form. The analysis shall identify the response(s) (verbal and/or body movements) that the operator must make.	N/A
Safety	Each task shall be evaluated to isolate the safety impact of the task for personnel and equipment.	Code: IV Negligible - condition(s) such that personnel error, deficiency/inadequacy of design or subsystem/ component malfunction will not result in system degradation and will not produce equipment damage or personnel injury.

FIGURE 2. Critical Task Analysis Instructions.

COLUMN TITLE	CRITERIA FOR DATA ENTRY	EXPLANATION CODE
Safety (continued)		Code: III Marginal - condition(s) such that personnel error, deficiency/inadequacy of design or subsystem/component malfunction will degrade system performance but which can be counteracted or controlled without major equipment damage or any injury to personnel. II Critical - condition(s) such that personnel error, deficiency/inadequacy of design of subsystem/component malfunction will degrade system performancy by causing personnel injury or substantial equipment damage or will result in a hazard requiring immediate corrective action for personnel or system survival. I Catastrophic - condition(s) such that personnel error, deficiency/inadequacy of design, or subsystem/component malfunction will severely degrade system performance and cause subsequent system loss or death or severe injuries to personnel.
Task Time	The time required in appropriate units shall be identified for each task/subtask which is analyzed.	As appropriate

FIGURE 2. Critical Task Analysis Instructions (Continued).

CRITICAL TASK ANALYSIS INSTRUCTIONS

COLUMN TITLE	CRITERIA FOR DATA ENTRY	EXPLANATION CODE
Task Tolerance	Column entries shall be coded to designate and identify unusual task tolerance requirements (i.e., reaction times, accuracy, force and perceptual requirements)	Code: To be submitted as required.
Task Frequency	Column entries shall be coded to state the number of times per M-minute, H-hour, W-week, or R-request, etc., the task is performed.	Code: Code shall state the number of times (x) that the task is performed in: x/M Minute x/H Hour x/W Week x/R Request
Task Locations	Column entries shall be coded to identify the task/operator location and the location(s) of required information input and required information output.	Code: To be submitted as required.
Workspace Environment	Column entries shall be coded to identify the stress effects on task performance which are produced by the working environment. Typical factors to be included are lighting, noise, vibration and temperature.	Code: To be submitted as required.
Workspace Required/ Provided	Column entries shall be coded to identify the required workspace necessary to perform the task. This analysis shall consider, among other factors, the reach envelope, volume and space for torquing. The column entry shall	Code: Reference to workspace drawings and layouts attached to the critical task analysis.

FIGURE 2. Critical Task Analysis Instructions (Continued).

CRITICAL TASK ANALYSIS INSTRUCTIONS

COLUMN TITLE	CRITERIA FOR DATA ENTRY	EXPLANATION CODE
Workspace Required/ Provided (Continued)	reflect any discrepancy between the workspace required and the workspace provided for each task.	
Number of Personnel	Column entry shall identify whether one (1) or more operators are involved in the task.	Code: A number or letter to represent each individual involved in order to portray required coordination.
AFSC (S)	Entries in this column consist of identifying Air Force Specialty Codes (AFSC's) for the personnel recommended to accomplish this task.	Code: A single number or letter to identify each applicable AFSC (to be submitted as required).
Tools Required	Entries in this column shall identify by code any special tools which are required in order to perform this task.	Code: To be submitted as required.
Communication	Entries in this column shall identify, via an established code, the communication equipment required for the performance of this task.	Code: To be submitted as required.
Machine Data/ Feedback	This column shall identify by narrative the feedback the operator receives from interaction with machines or other operator as a result of task performance.	N/A

FIGURE 2. Critical Task Analysis Instructions (Continued).

CRITICAL TASK ANALYSIS INSTRUCTIONS

COLUMN TITLE	CRITERIA FOR DATA ENTRY	EXPLANATION CODE
Remarks	Entries in this column shall be coded, and identify, by reference to an attached remarks having to do with the particular task.	Code: Reference to remarks sheet(s) attached to the Critical Task Analysis.

FIGURE 2. Critical Task Analysis Instructions (Continued).

e. The panel layout drawings including a layout of the controls and displays on each panel of an item of equipment, such as a status/control console, or command/communication console; a description of all symbols used; and identification of the color coding used for displays and controls.

50.3 Recordation. Critical task analyses shall be recorded on a format as shown in Figure 3. Preparation will be in accordance with the instructions of Figure 2. Where the critical task analysis is based upon LSA, enter the LSA control number and task codes.

60. NOTES. (Not applicable.)

CRITICAL TASK ANALYSIS FORMAT

Function Number and Title															Revision	Date
Information Required/ Available	Evaluation/ Decision	Task (Action)	Safety	Task Time	Task Tolerance	Task Frequency	Task Location(s)	Workspace Environment	Workspace Required/ Provided	No. of Personnel	AFSC(s)	Tools Required	Communi-cation	Machine Data/ Feedback	Remarks	

FIGURE 3. Critical Task Analysis.

APPENDIX C

HUMAN FACTORS TEST AND EVALUATION RECORD

10. SCOPE

10.1 Purpose. This appendix identifies and defines information pertaining to the HFTE which the contractor shall be required to record and retain.

10.2 Application. This appendix is a mandatory requirement of this standard and is applicable to all ICBM program associate contractors.

20. REFERENCED DOCUMENTS. (Not applicable.)

30. DEFINITIONS. (Not applicable.)

40. GENERAL REQUIREMENTS

40.1 Data usage. The contractor shall record and retain the data identified herein. The data contained in the record shall be used as a basis for HFTE Summary Reports. Use DI-H-3272, paragraph 10.2.b.

40.2 Format. HFTE data shall be recorded on a format the same as or similar to Figure 4, and shall contain all of the information identified thereon. The HFTE record shall be summarized on a form the same as or similar to Figure 5.

40.3 Availability for review. The HFTE record shall be available for review by SAMSO/MNTP, or as they so direct, at all times during normal company working hours.

50. DETAILED REQUIREMENTS

50.1 HFTE test record.

50.1.1 Preparation instructions. The contractor's HFTE Observer/Evaluator shall record the results of his HFTE as follows:

50.1.1.1 Maintenance/logistics data.

a. Record all faults and annotate those faults which required either the replacement of equipment or a specific maintenance task (adjust, calibrate, etc.) in accordance with technical data.

b. Record each instance when spares were not provisioned or were ineffective in eliminating the faults when installed in accordance with technical data.

c. Record each instance when maintenance support equipment was required by the technical data, was available and used, or was excess.

HFTE TEST RECORD

Test Planning Analysis No(s) _____ Date _____

Test Increment No. _____ Test Procedure No. _____

Title _____

Test Procedure _____

Paragraph No. _____ Date Observed _____

Observer(s) _____ Test Location _____

LSA Control Numbers _____

MAINTENANCE/LOGISTICS DEFICIENCY: Yes ☐ No ☐ Task/Step _____

Malfunctions Observed _____

Malfunctions Indicated by Equipment _____

Malfunction Isolation _____

Spares: Provisioned Yes ☐ No ☐ Available Yes ☐ No ☐ Effective Yes ☐ No ☐

MSE: Used Yes ☐ No ☐ Inoperative or Malfunctioned Yes ☐ No ☐

Effective Yes ☐ No ☐ _____

MSE: Required by Tech Data Yes ☐ No ☐ _____

Available Yes ☐ No ☐ _____

Tech Data Adequate: Yes ☐ No ☐ _____

Recommendation _____

BIOMEDICAL DEFICIENCY: Yes ☐ No ☐ Task/Step _____

Deficiency _____

Probable Cause _____

Impact _____

Recommendation _____

FIGURE 4. HFTE Test Record Form.

WORKSPACE LAYOUT DEFICIENCY: Yes ☐ No ☐ Task/Step _____

Deficiency _____

Impact _____

Alternate _____

Communications Deficiency Yes ☐ No ☐ _____

Equipment Change _____

Facility Change _____

Other _____

Recommendation _____

EQUIPMENT DESIGN DEFICIENCY: Yes ☐ No ☐ Task/Step _____

Panel Layout _____

Displays/Markings _____

Controls _____

Accessibility/Operability _____

Fault Indication/Isolation _____

Handling Provisions/Packaging _____

Maintainability _____

Recommended Design Changes _____

TECHNICAL DATA DEFICIENCY: Yes ☐ No ☐ Task/Step _____

Technical Data Status: Unvalidated ☐ Validated ☐ Verified ☐

T.O. No. and Title _____

Performance Difficult Yes ☐ Task _____

_____

Deviation in Task Sequence Yes ☐ Deviation _____

Task Sequence Correct No ☐ Correction _____

Task Time Phasing Correct No ☐ Correction _____

Deviation in Task Performance Yes ☐ Deviation _____

Improper Use of Equipment Yes ☐ Deviation _____

Impact of Deviations _____

_____

Recommended Change _____

FIGURE 4. HFTE Test Record Form (Continued).

Page 2 of 4 pages

TIMELINE DEFICIENCY: Yes ☐ No ☐ Task/Step _____

Time: Specified: _____ Start: _____ Comp: _____ Used: _____ Hold: _____

Reason: Timeline Estimate Incorrect ☐ Other: _____

Change Recommended to Reduce Required Time _____

Change Time From _____ To _____

Timeline _____

Impact _____

TRAINING DEFICIENCY: Yes ☐ No ☐ Task/Step _____

Did Subject Receive Training Yes ☐ Where/When _____

Why was Training Inadequate _____

Recommendation _____

_____

Was TE Recommended Yes ☐ No ☐ Available Yes ☐ No ☐

TE Design Deficiency Yes ☐ Deficiency _____

Other _____

Recommendation _____

PERSONNEL REQUIREMENTS DEFICIENCY: Yes ☐ No ☐ Task/Step _____

Pers: Specified: _____ Used: _____

Different Numbers Required Yes ☐ _____

QQPRI AFSC = Tech Data AFSC = Assigned AFSC No ☐ Deficiency _____

Used AFSC Qualified No ☐ Deficiency _____

Different/additional AFSC required Yes ☐ _____

Recommendation _____

FIGURE 4. HFTE Test Record Form (Continued).

PERSONNEL SAFETY DEFICIENCY: Yes ☐ No ☐ Task/Step _____

Failure to Follow Emergency Procedure _____

Failure to Follow Caution/Warning _____

Potential Hazard _____

Near Accident _____

Accident _____

Injury to Personnel _____

Damage to Equipment _____

Ambiguous Tech. Data _____

Ambiguous Equip. Placard _____

Recommendation _____

TEST ANOMALIES: Yes ☐ No ☐ Task/Step _____

Estimated Impact on Test Validity: Critical ☐ Major ☐ Minor ☐ None ☐

Administration: Yes ☐ No ☐

Control Records Adequate No ☐ _____

Administrative Control Adequate No ☐ _____

Nature of Deficiency _____

Probable Cause _____

Recommendation _____

Human Error: Yes ☐ No ☐ Task/Step _____

Nature of Error _____

Probable Cause _____

Recommendation _____

Test Instrumentation Deficiency: Yes ☐ No ☐ Task/Step _____

Test Instrument Deficient _____

Nature of Deficiency _____

Recommendation _____

Test Planning/Implementation Deficiency: Yes ☐ No ☐ Task/Step _____

Nature of Deficiency _____

Recommendation _____

FIGURE 4. HFTE Test Record Form (Continued).

HFTE SUMMARY FORM No. _____

Test Planning Analysis No. _____

Test Procedure No. _____

TITLE: _____

Deficiency Observed: YES ☐ NO ☐ Date Observed: _____

Observer(s): _____ Test Location: _____

Time: Specified: ____ Start: ____ Comp: _ ___ Used: _____ Hold: _____

Personnel: Specified: _____ Used: _____

Tech Data _____

Tech Order Status: Unvalidated ☐ Validated ☐ Verified ☐

Para/Fig No. _____

End Items of Equip _____

Component _____

Problem Classification:	Critical	Major	Minor	Retest Req'd	None
Observer:	☐	☐	☐	☐	
HFTE W/G:	☐	☐	☐	☐	☐

UER _____

Previously Reported On HSF No. _____

Deficiency Category

- ☐ Maintenance/Logistics
- ☐ Technical Data
- ☐ Personnel Reqm'ts
- ☐ Biomedical Support
- ☐ Timeline
- ☐ Personnel Safety
- ☐ Workspace Layout
- ☐ Training
- ☐ Test Anomaly
- ☐ Equipment Design/ Maintainability

Deficiency Description:

Observer Recommendations:

Working Group Action:

FIGURE 5. HFTE Summary Form.

d. Record each instance when required maintenance support equipment was not identified in the technical data, was inoperative, malfunctioned, or was ineffective.

50.1.1.2 Biomedical support data.

a. Record all instances when personnel are unable to read technical data or are unable to perform required functions because of improper illumination, including glare from reflecting surfaces.

b. Record all instances when normal verbal communication or other activities are degraded due to interfering noise.

c. Record performance deficiencies which may be associated with biomedical criteria and describe the environmental conditions that contributed to the deficiency.

50.1.1.3 Workspace layout data.

a. Record all instances where personnel were unable to perform operations and maintenance tasks due to configuration, layout, or workspace limitations.

b. Record all instances where performance errors or inability to communicate could be attributed to equipment configuration or workspace layout.

50.1.1.4 Equipment design/maintainability data.

a. Record all instances where equipment design contributed to inefficient or incorrect human performance during operations and organizational and intermediate level maintenance.

b. Record all instances where specified maintenance support equipment failed to support organizational and intermediate maintenance levels.

c. Record all instances where additional direction, caution or warning placards are required.

d. Record all instances where additional or modified maintenance support equipment is required or recommended to accomplish defined maintenance objectives.

e. Record performance errors or difficulties attributable to deviations from human factors engineering criteria.

50.1.1.5 Technical data.

a. Record status of technical data, i.e., unvalidated, validated, verified.

b. Record all instances when technical procedures are not followed by operations or maintenance personnel.

c. Record all instances where ineffective performance or delays occur due to ambiguity in the procedures.

d. Record all instances where procedures, when followed by personnel, fail to accomplish the intended operations or maintenance functions.

e. Record all instances where additional notes, cautions and warnings are required.

f. Record technical data deficiencies such as induced delays, omitted or incorrect procedures, support equipment or spares, and incorrect sequences.

g. Record the impact on the validity of test observations, and results for each HFTE element, including confirmation of the adequacy of the technical data. Post-test analysis may be required to fully assess this impact.

50.1.1.6 Timeline validation data. Record the time required to perform operations and maintenance tasks.

50.1.1.7 Training data acquisition. Record instances when the operations or maintenance tasks performed by personnel are:

a. Incorrect.

b. Deviations from prescribed procedures.

c. Inefficient due to a lack of task proficiency.

50.1.1.8 Personnel requirements data acquisition.

a. Record the number of personnel or the number and Air Force Specialty Code(s) specified in the SRA data or the QQPRI required to perform the operations or maintenance activities, and the numbers and/or type of personnel actually used to perform the task.

b. Record all instances where personnel performance was ineffective due to deficiency in the number and/or specialty code of the personnel performing the operations or maintenance task.

50.1.1.9 Personnel safety data.

a. Record all personnel injuries that occur.

b. Record all near accidents.

c. Identify hazardous or potentially hazardous conditions or procedures.

d. Record all instances of equipment damage.

e. Record all instances where personnel failed to comply with emergency procedures, cautions and warnings.

f. Record any ambiguous emergency procedures, notes, cautions and warnings found in the technical data or on placards.

50.1.1.10 Test anomalies.

a. Record all instances of administrative problems such as ineffective job control practices in dispatch or inadequate control records.

b. Record all instances of test planning/implementation problems such as commercial power failure, equipment failure, unexpected weather conditions, or inappropriate or faulty test instrumentation.

c. Record all instances of human error attributable to the test subject such as fatigue, inattention, or physiological impairment.

50.2 HFTE summary.

50.2.1 Format. HFTE test results shall be recorded by the HFTE Observer/Evaluator on an HFTE summary form which shall be the same as or similar to Figure 5 and shall contain all of the information identified thereon.

50.2.2 Preparation instructions. The following information shall be recorded on the HFTE summary form:

a. HFTE summary form number. The HFTE Summary Form (HSF) log number is entered by the individual responsible for keeping a log of HSFs. The HSF identification shall include the test increment identification number followed by a number indicating the sequence of the HSF submitted for that test increment.

b. Test planning analysis number. Enter the test planning analysis number(s) applicable to the test.

c. Test procedure number. Enter the identification number of the applicable test procedure.

d. Date observed. Enter the date the test was observed.

e. Title. Enter the title of the test procedure that was observed and, if a problem occurred, enter the specific task title, in parentheses, for the task that was being performed when the problem occurred.

f. Deficiency observed. The deficiency-observed blocks are used to indicate whether the HSF reports an observed test with or without deficiencies. If "No" is checked, then only the blanks above the dotted line shall be completed, and the HSF shall be retained on file.

g. Observer(s). Enter the name(s) of the person(s) who actually made the observation.

h. Test location. Enter the site or support area where the data were collected.

i. Time.

Specified - enter the time specified in the applicable document for the function observed.

Start - enter the time the observed function was started.

Comp - enter the time the observed function was completed.

Used - enter actual time used to perform the observed function, including hold time.

Hold - enter actual work time lost due to work stoppage resulting from lack of personnel, support equipment, correction of procedures, malfunctions, etc.

j. Personnel. List the number of contractor personnel or the number and AFSCs as called out in the applicable document after "SPECIFIED." Enter the number of contractor personnel or the number and AFSCs that actually participated in the test after "USED."

k. Tech data. Enter the tech data number or T.O. number and change identification for the technical data used during the observation.

l. Tech order status. Check whether the tech data used were unvalidated, validated or verified. If several T.O.s of different status were used, indicate the status of each.

m. Para/fig. number. Enter the technical data paragraph number(s) and/or figure number(s) applicable to the problem being reported.

n. End items of equip. The part number, with dash number, serial number and nomenclature of the specific piece of equipment involved in the problem. The configured item specification identification should also be entered.

o. Component. Identify the specific component against which the HSF is being written.

p. Problem classification. The HFTE Observer/Evaluator shall check one or more of the applicable classifications as defined below. The HFTE Working Group (HFTE W/G), after analysis and investigation, shall check the applicable classifications.

Critical - A problem shall be classified as critical if the uncorrected problem would result in a system failure or an extreme personnel safety hazard.

Major - A problem shall be classified as major if the uncorrected problem would result in a probability of system failure, personnel safety hazard or substantially lowered in-commission rate.

Minor - A problem shall be classified as minor if the uncorrected problem degrades system performance or efficiency but does not create a high probability of system failure or personnel safety hazard.

Retest required - This classification shall be used when sufficient data could not be obtained, HFTE test objectives were not accomplished, or the function was performed with changes or deviations from technical data procedures. Test anomalies shall be analyzed to determine the impact of the anomaly on the validity of the test data and resulting requirement for a retest.

None - This classification shall be used by the HFTE W/G to indicate that a problem does not exist.

q. UER. Enter the Unscheduled Event Record (UER) identification, of the problem, if any.

r. Previously reported on HSF No. Enter the number of the HSF on which the problem was previously reported, if any.

s. Deficiency description. Clearly state the specific problem detected during the test operation. This section of the HSF shall also include a discussion of the problem in sufficient detail so that it may be evaluated by the HFTE W/G and SAMSO personnel reviewing the problem. Reasons for holds shall be given. It must be clearly stated what specifically would happen if this deficiency were not corrected.

t. Observer recommendation. This heading and entry shall be typed on the form after the above entries have been made. Specific recommendation(s) to correct the deficiency shall be made.

u. Working group action. This heading and entry are typed on the form after the above entries have been made. The HFTE W/G shall provide an evaluation of the problem and make appropriate problem disposition and/or recommendations.

50.2.3 Reporting. A copy of each HFTE summary which identifies one or more deficiencies shall become a part of the HFE progress report, required by Appendix D, covering the period during which the HFTE activity was conducted.

60. NOTES. (Not applicable.)

APPENDIX D

HUMAN FACTORS ENGINEERING PROGRESS REPORTS

10. SCOPE

10.1 Purpose. This appendix identifies and defines the preparation of certain data requirements to be submitted by the contractor as a part of his progress report.

10.2 Application. This appendix is a mandatory requirement of this standard and is applicable to all ICBM program associate contractors.

20. REFERENCED DOCUMENTS. (Not applicable.)

30. DEFINITIONS. (Not applicable.)

40. GENERAL REQUIREMENTS

40.1 Preparation. Prepare in accordance with Part II, DI-H-3251, as further explained and clarified herein.

40.2 Contents. Progress reports shall include the following, as applicable:

40.2.1 Study reports. Include the results of studies, experiments, and engineering development and laboratory tests required by 5.2.2.2 in a specifically identified portion of the report. No specific format is required. However, include a description of the problem(s) associated with the equipment and, if the problem is unsolved, a description of the proposed effort to resolve the problem.

40.2.2 Special effort. Include recommendations for special studies, experiments, and laboratory tests outside the scope of the approved HFDP, as amended, or contractor furnished equipment. No specific format is required. Include a description of the problem and justification for the proposed action.

40.2.3 Mockups, models and simulations. Include recommendations for special mockups for use in human factors engineering efforts, and for major human factors engineering mockups, models, and dynamic simulation.

40.2.4 Critical tasks. Identify and discuss those gross tasks not previously identified and approved for critical task analysis but which require critical human performance, reflect potentially unsafe practices, or are subject to promising improvements in operating efficiency. No specific format is required. However, the discussion shall justify the contractor's opinion.

40.2.5 HFTE Summary. Human factors engineering deficiencies discovered during HFTE and recorded in accordance with 50.2 of Appendix C shall be reported in the progress report for the period during which the HFTE activity was conducted. A copy of the HFTE Summary Form, Figure 5, may be attached to

comply with this requirement. If the analysis and investigation of the deficiency has not been completed in time to be included in the report, the form shall be annotated as incomplete and the complete report shall be included in a later progress report. HFTE Summary Forms which do not identify a deficiency shall not be a part of the progress report but shall be retained in the contractor's file as required by 40.1 of Appendix C.

50. DETAILED REQUIREMENTS

50.1 Human engineering and biomedical deficiency report. A human engineering and biomedical deficiency report shall be a part of the progress report, as applicable. This report shall be prepared on a form the same as or similar to, and shall contain all of the information contained on, Figure 6. Each such report shall be supported by and shall have attached thereto a description of each deficiency prepared on a form the same as or similar to Figure 7.

50.1.1 Deficiency report. Figure 6 shall be prepared as follows for each CI number.

a. Enter the date the report is prepared.

b. If this is a revision to a previously submitted report, enter the revision number.

c. Enter the CI number and the item nomenclature in the spaces provided therefor.

d. Circle the appropriate equipment category (AVE, OSE, MSE, TRAINER). If OTHER, identify.

e. Place an X in the proper block to identify the design status (PRE-SDR, SDR, PDR, CDR, POST-CDR) of the CI number being reported.

f. Under the deficiency identification column, enter the same identification as is on the deficiency description form attached. Note that a deficiency description form shall be prepared for each identified deficiency recorded on the deficiency report forms.

g. Under the disposition status column, indicate the disposition if the deficiency has been disposed of. If final disposition has not been made, indicate the status of the deficiency at the time the report is prepared.

50.1.2 Deficiency description. A copy of the deficiency description, Figure 7, shall be prepared for each description discovered and a copy thereof shall be attached to the appropriate deficiency report. This form shall be prepared as follows:

a. Enter the date the deficiency description form is prepared. This is not necessarily the same date as will appear on the deficiency report.

HUMAN ENGINEERING/BIOMEDICAL
DEFICIENCY REPORT

DATE _____

REVISION _____

CI NO. _____

ITEM _____

EQUIPMENT CATEGORY: AVE OSE MSE TRAINER OTHER _____

DESIGN STATUS PRE-SDR ☐ SDR ☐ PDR ☐ CDR ☐ POST-CDR ☐

The design of this CI complies with requirements of MIL-STD-1472 and other contractual direction, except for the deficiencies identified below. A detailed description of each deficiency and associated proposed requirements changes is attached.

DEFICIENCY IDENTIFICATION	DISPOSITION STATUS

FIGURE 6. Human Engineering/Biomedical Deficiency Report Form.

HUMAN ENGINEERING/BIOMEDICAL
DEFICIENCY - DESCRIPTION

DATE _____

REVISION _____

CI NO. _____

ITEM _____

DEFICIENCY

PROPOSED CHANGE AND RATIONALE

COMMENTS

COGNIZANT ENGINEER _____ TEL NO. _____

FIGURE 7. Human Engineering/Biomedical Deficiency Form.

b. If this is a revision to a previously prepared deficiency description, enter the revision number. This is not necessarily the same revision number as appears on the deficiency report.

c. Enter the CI number and item nomenclature for the specific item to which the deficiency pertains.

d. In the space marked deficiency, enter a description thereof which will be sufficiently detailed for a reviewer to understand the problem. A lengthy dissertation is discouraged. Be concise and explicit. This information shall be entered on the deficiency report under deficiency identification.

e. The contractor's proposed change and the rationale therefore shall be entered in the space provided. If additional space is required, a continuation sheet of plain bond may be added.

f. Any additional comments the contractor may have should be entered on the lower portion of the form in the space marked comments. If additional space is required, a continuation sheet of plain bond may be added.

g. The name of the contractor's cognizant engineer and his telephone number, with extension if any, shall appear on the form in the space provided.

60. NOTES. (Not applicable.)

APPENDIX E

QUALITATIVE AND QUANTITATIVE PERSONNEL REQUIREMENTS INFORMATION (QQPRI)

10. SCOPE.

10.1 Purpose. This appendix identifies and defines certain data requirements placed on the contractor.

10.2 Application. This appendix is a mandatory requirement of this standard and is applicable to all ICBM program associate contractors.

20. REFERENCED DOCUMENTS. (Not applicable.)

30. DEFINITIONS. (Not applicable.)

40. GENERAL REQUIREMENTS.

40.1 Content. The QQPRI shall contain the results of manpower and personnel studies and analyses required by 5.3.

50. DETAILED REQUIREMENTS.

50.1 Preparation instructions.

50.1.1 Part I. QQPRI for operations and organizational and intermediate level maintenance support. Prepare in accordance with DI-H-3253 as further explained in 3.2.1a of MIL-D-26239, except that the following changes are made to MIL-D-26239.

a. Delete reference to section 3.

b. Appendix I-3 - delete.

c. Appendix I-4 - delete 4-1.1. (No new position titles shall be considered.)

d. Appendix I-4 - delete 4-1.2.2 and 4-1.2.3.

e. Appendix I-4 - 4-1.3 a - the terms "duty" and "task" shall correspond with "function" and "task" as provided in the system SRA (SAMSO-STD-77-6).

f. Appendix I-4 - 4-1.3 b and c - the duties/functions and tasks/tasks shall be organized by system/subsystem and equipment/facilities "operated" (in the Air Force "operations" meaning - the OGE operated to perform command and control functions) or "maintained" at the organizational and intermediate maintenance levels (the AVE, OSE and MSE worked-on). The functions and tasks shall include their SRA identification number and shall be considered in sequence under each subsystem/equipment/facilities item.

g. Appendix I-4 - 4-1.5 a, b and c - the time/place/frequency data shall be identical to the same data contained in the system SRA. Definitions for SRA data codes used here and elsewhere shall be provided in the QQPRI.

h. Appendix I-4, delete 4-1.5 d.

i. Appendix I-4, 4-1.6 - the requirements shall be satisfied by including the "Task Characterization" and "Training Characterization" codes after each task statement as provided in the system SRA.

j. Appendix I-5 - delete 5-1.2.

k. Appendix I-5 - 5-2 - change second sentence to read as follows: "These estimates shall be broken down by Air Force organizational structure, shops, crews and teams as appropriate to define the manning."

l. Appendix I-5 - 5-2 a - revise to read: "The Air Force Specialty titles shall be provided for the personnel within each respective organization."

m. Appendix I-5 - 5-2 b - revise to read: "The AFSC associated with each Air Force Specialty shall be provided."

n. Appendix I-5 - delete 5-2 c, d and e.

50.1.2 Part II. QQPRI for depot level maintenance support. Prepare in accordance with DI-H-3254 as further explained in 3.2.1b of MIL-D-26239.

60. NOTES. (Not applicable.)